

How Sweet It Is!

A Study of Viscosity

Part 1:

Record your answers on your Preliminary Investigation Result Sheet.

Have you ever kept syrup in a refrigerator? Describe the behavior of the syrup when it is very cold.

What happens when the syrup begins to warm up?

Viscosity describes the “thickness”, or resistance to flow of a fluid. A fluid with a low viscosity will flow easily, while one with a high viscosity will not. Water would have a low viscosity, while syrup would have a higher one.

Viscosity is often measured by the time it takes for a fluid to flow through a hole of some kind. Another method could be to time how long it takes an object to fall through the liquid.

Do you think that viscosity is related to temperature? Sketch what you think a graph of viscosity vs. temperature would look like on your results sheet and justify your answer.

Investigation 1:

What happens to an object’s viscosity as the temperature changes?

Suggested Materials:

- Corn syrup
- several medium sized test tubes
- BB's
- stopwatch
- styrofoam cups
- ice
- a source of hot water
- TI 83+ calculator, CBL 2 and Temperature Probe (or a thermometer)

Discuss with your group the task assigned. Develop a plan to experimentally determine what effect temperature has on viscosity of syrup. You will measure viscosity by timing how long it takes for a BB to fall through the syrup. Be sure and let your teacher check your plan before you start.

Pay particular attention to any safety directions given by your teacher.

1. Which will be the independent variable and which will be the dependent variable?
2. Plot a graph of your data. Sketch what your graph looks like on the results sheet. Be sure and label the axes properly. Describe in your own words what the graph tells you. Comment on how the actual graph compares to your prediction.
3. Find a mathematical function that fits the data. Explain the meaning of the function in your own words.
4. Rewrite your function in words, and include all appropriate units.
5. What problems might occur if motor oil behaved the same way that syrup does?
6. An old TV commercial for ketchup showed it flowing very slowly. Assuming the ketchup behaves like corn syrup, how could you make the ketchup flow faster?

DRAFT

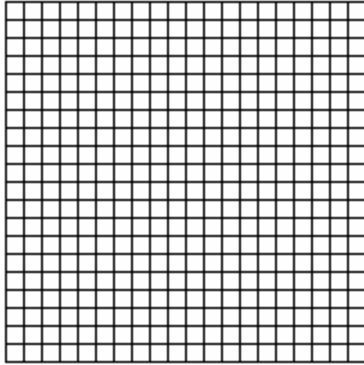
Investigation Results Sheet: Viscosity and Temperature

Independent variable

Dependent variable

Prediction:

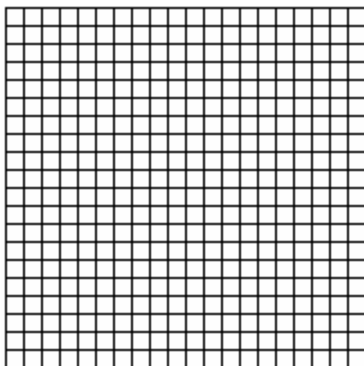
Graph's meaning:



Temperature (°C)	Time (s)

Investigation:

Graph's meaning:



Function and meaning

DRAFT

Soda Stuff!

You work for a soda bottling company, and corn syrup is the sweetener used to make your sodas. The syrup is allowed to gravity flow from a large tank to your bottling machines. In order for the syrup to flow at the proper rate, it has been determined that the “BB” viscometer time reading should be 5s. What temperature should you keep the syrup tank in order for the syrup to flow properly? Show all your work and explain your thinking

Volcano Viscosity

Viscosity is an important property that is used in the study of volcanoes. Here is some actual data from eruptions of Mauna Loa in Hawaii. It includes the date of the eruption, the location where the measurements were taken and an estimation of the viscosity of the lava at that point. Study the data and discuss the conclusion you draw. Be sure and address how this relates to what you have learned about viscosity.

Date	Location	Viscosity
5/4/42	Edge of cone at vent	3×10^3
1/20/49	0.6 km away from the vent	5×10^3
6/2/50	20 km away from the vent	7×10^3

*the vent is where the lava comes out of the ground

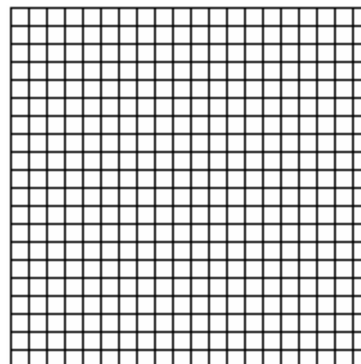
Assessment

Here is some sample data from a viscosity experiment.

Temperature ($^{\circ}\text{C}$)	Time (s)
50	4
40	12
30	20
20	28
10	36

1. Determine the function that fits this data. Show your work and explain your thinking

2. Sketch a graph of the data and explain the meaning of the graph.



3. Determine what the time should be if the temperature is 21°C .